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Renewable energy policies and initiatives for a sustainable energy future in Malaysia

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ABSTRACT

Effective policies and incentive on renewable energy (RE) is critical to promote low carbon economy and society in the future. RE was first introduced in the country's energy mix through the Fifth-Fuel Policy which was formulated under the Eighth Malaysia Plan (2001–2005) to reduce dependency on fossil fuel and to address the rising global concern on climate change. This paper addresses the RE progress and achievement over the past 10 years, and discusses the key policies for RE programmes, funding, schemes, and incentives that has been introduced by the government of Malaysia to develop and promote the utilisation of RE. The recent RE mechanisms under the Tenth Malaysia Plan (2011–2015) will also be highlighted.

Contents

Abbreviations: RE, renewable energy; SREP, small renewable energy power programme; 8MP, Eighth Malaysia Plan; BioGen, biomass generation and demonstration project; GoM, Government of Malaysia; 9MP, Ninth Malaysia Plan; MBIPV, Malaysia building integrated photovoltaic; CETREE, Centre for Education and Training in Renewable Energy and Energy Efficiency; 10MP, Tenth Malaysia Plan; FiT, feed-in tariff; 7MP, Seventh Malaysia Plan; EE, energy efficiency; KeTTHA, the Ministry of Energy, Green Technology and Water; SIRIM, Standards and Industrial Research Institute of Malaysia; GT, green technology; PV, photovoltaic; SCORE, Special Committee on Renewable Energy; REPPA, Renewable Energy Power Purchase Agreement; TNB, Tenaga National Berhad; GHG, greenhouse gas; UNDP, United Nation Development Programme; GEF, global environment facility; PS, pioneer status; ITA, investment tax allowance; MIDA, Malaysian Industrial Development Authority; SEDA, Sustainable Energy Development Authority; REBF, Renewable Energy Business Fund; GTFS, Green Technology Financial Scheme; PTM, Pusat Tenaga Malaysia; BPMB, Bank Pembangunan Malaysia Berhad; MESITA, Malaysian Electricity Supply Industry Trust Account.

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1. Introduction

Initiatives on sustainable development are currently aggressively pursued throughout the world. The Malaysian government has developed key policies and strategies for over 30 years to achieve the nation's policy objectives which are designed to mitigate the issues of security, energy efficiency and environmental impact to meet the rising energy demand. Malaysia's current focus is on developing effective policies on renewable energy (RE) in order to reduce dependency on fossil fuel and contribute towards mitigating the effects of climate change. Presently, renewable energy project in Malaysia have been slow to materialize. However, concerted efforts such as the government's policies and initiatives are currently undertaken by the government to develop and promote the utilisation of renewable energy resources.

In order to address the concern of energy security, Malaysia introduced the "Four-Fuel Diversification Strategy" in 1980 and started to develop more hydropower and encouraged the use of natural gas and coal to reduce complete dependency on oil in the wake of the energy crisis of the 70s. In 8th Malaysia Plan (8MP – 2001–2005), the fifth-fuel strategy was introduced to promote the use of RE as well as to address rising global concern on climate change. A year after the introduction of the Fifth Fuel Policy, the Small Renewable Energy Power (SREP) Programme was launched in May 2001. A target of 350 MW of electricity generation from RE such as biomass, biogas, municipal waste, solar and mini-hydro as alternatives to fossil fuel was set but has so far not been achieved. In order to ensure the development during 8MP, Biomass Generation and Demonstration (BioGen) Project was launched and various incentives were given by the government to realize this target but only two RE power plants were commissioned with a total capacity of 12 MW [1]. Despite the slow progress, Government of Malaysia (GoM) persevered in the notion to increase the utilisation of RE under the 9th Malaysia Plan (9MP – 2006–2010) by enhancing the use of RE and biomass resources from oil palm, wood, rice husks residue for the purpose of heat and electricity generation and biomass co-generation systems. In addition, under the 9MP, the National Biofuel Policy 2006 and the National Green Technology Policy 2009 were launched in effort to promote RE resources. Addition of two RE programmes was also launched under the 9MP, namely Malaysia Building Integrated Photovoltaic (MBIPV) and Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE). MBIPV is mainly for solar energy developments and CETREE is mainly to increase the awareness of the importance of RE to the public through education and training

However, by the end of the 9MP, RE contribution towards the country's total energy mix through grid-connected power generation from SREP only achieved 56.7 MW [1]. Due to this scenario, Malaysia aggressively continues its goal to promote and increase the share of RE in the country's energy mix under the 10th Malaysia Plan (10MP – 2011–2015) which begin in year 2011. In the 10MP, the new energy target to achieve is of 985 MW by 2015 contributing to 5.5% of Malaysia's total electricity generation mix. In order to achieve its target, the National Renewable Energy Policy 2010 is recently launched. Several new initiatives anchored upon the Renewable Energy Policy 2010 and Action Plan will be undertaken [2]. Among the measures taken includes; the introduction of a Feed-in Tariff (FiT) and establishment of a RE fund from the FiT [2]. Furthermore, two acts, Renewable Energy Act and the Act for a FiT implementing agency, are expected to be launched by 2011 [3]. This paper discusses the progress and achievement on RE, key policies for RE programmes, funding, schemes, and incentives that has been introduced by the government of Malaysia to develop and promote the utilisation of RE over the past 10 years. New recent policies and initiatives under 10MP will also address.

2. Initiatives and action plans for renewable energy

Since the Seventh Malaysia Plan (7MP – 1996–2000), emphasis has been based on sustainable development while RE was stressed upon since the 8MP. Over the 15 years (7–9MP), RM 154 million for 176 projects has been funded for RE research and developments to universities, research institutes and industries focusing on developing technologies to harness energy from biomass, solar, mini-hydro, winds and oceans [4]. Up to now, even with the target of 300 MW in Peninsular Malaysia and 50 MW for Sabah and Sarawak, but only 56.7 MW of energy in Malaysia is produced from RE sources [1]. Currently, as of year 2011, Malaysia is currently under the 10MP where aggressive initiatives are put into RE developments. Table 1 shows the Malaysia's key emphasis from 7MP to 10MP for energy development.

2.1. Energy policies

National Energy Policy is the first Malaysia's energy policy emphasising on oil and gas resources to serve the need of energy in Malaysia. The main purpose of the policy is to ensure the availability of the energy supply and that the supplies are reasonable in price to support the nation's economy developments. Under this policy, the Ministry of Energy, Green Technology and Water (KeTTHA) has identified three principal energy objectives that would be instrumental in guiding the development of its energy sector [6].

The three principals of National Energy Policy [6]:

(1) *Supply*: To ensure the provision of adequate, secure and cost-effective energy supplies through developing indigenous energy resources both non-renewable and RE resources using the latest cost options and diversification of supply sources both from within and outside the country.
(2) *Utilisation*: To promote the efficient utilisation of energy and discourage wasteful and non-productive patterns of energy consumption.
(3) *Environmental*: To minimize the negative impacts of energy production, transportation, conversion, utilisation and consumption on the environment.

In order to promote the utilisation of RE, GoM further introduce several other policies such as the Fifth Fuel Policy 2000, National Biofuel Policy 2006, National Green Technology Policy 2009 and the latest, yet to be launched National Renewable Energy Policy 2011.

2.1.1. Fifth Fuel Policy 2000

Fifth Fuel Policy (8MP – 2001–2005) – In the 8MP, RE was announced as the fifth fuel in the energy supply mix. RE is being targeted to be a significant contributor to the country's total electricity supply. With this objective in mind, greater efforts are being undertaken to encourage the utilisation of renewable resources,

Table 1
Malaysia's key emphasis from 7 MP to 10 MP for energy development [5].

Malaysia plan	Key emphasis
Seventh Malaysia Plan (1996–2000)	Emphasis on sustainable development and of depletable resources and the diversification of energy resources. Ensuring adequacy of generating efficiency as well as expanding and upgrading the transmission and distribution infrastructures. Encouraged the use of new and alternative energy sources as well as efficient utilisation of energy.
Eighth Malaysia Plan (2001–2005)	Emphasis on the sustainable development of energy resources, both depletable and renewable. The energy mix includes five fuels: oil, gas, coal, hydro, and RE. Intensive efforts on ensuring adequacy, quality and security of energy supply. Greater emphasis on energy efficiency (EE): encourage efficient utilisation of gas and RE as well as provide adequate electricity generating capacity. Supports the development of industries in production of energy-related products and services. Highlights in promoting RE and EE: Incentives for EE. Incentives for the use of RE resources. Incentives to maintain quality of power supply.
Ninth Malaysia Plan (2006–2010)	Emphasis on strengthening initiatives for EE especially in transport, commercial and industrial sectors, and in government buildings. Encourage better utilisation of RE through diversify fuel sources. Intensify efforts to further reduce the dependency on petroleum provides for more to integrate alternative fuels. Incentives in promoting RE and EE are further enhanced.
Tenth Malaysia Plan (2011–2015)	Short term goals vested in National Green Technology Policy: Increased public awareness and commitment for the adoption and application of green technology through advocacy programmes. Widespread availability and recognition of green technology in terms of products, appliances, equipment, and systems in the local market through standards, rating and labelling programmes. Increased foreign and domestic direct investment in green technology manufacturing and services sector. Expansion of local research institutes and institutions of higher learning to expand research, development and innovation activities on green technology towards commercialization through appropriate mechanisms. New RE act and FiT mechanism to be launched.

such as biomass, biogas, solar and mini-hydro, for energy generation [7].

2.1.2. National Bio-fuel Policy 2006

National Biofuel Policy 2006, is launched in support of the Fifth Fuel Policy and it is aimed to reduce the country's dependency on depleting fossil fuels, and promoting the demand for palm oil as a source of RE. Five key thrusts includes: transport, industry, technologies, export and cleaner environment [4].

The highlights of National Biofuel Policy 2006 [5]:

(1) Producing a biodiesel fuel blend of 5% processed palm oil with 95% petroleum diesel.
(2) Encouraging the use of biofuel by giving incentives for providing biodiesel pumps at fueling stations.
(3) Establishing industry standard for biodiesel quality under Standards and Industrial Research Institute of Malaysia (SIRIM).
(4) Setting up of a palm oil biodiesel plant.

2.1.3. National Green Technology Policy 2009

National Green Technology Policy 2009 is launched to promote Green Technology (GT) as a driver to accelerate the national economy and to promote sustainable development.

Objectives under National Green Technology Policy 2009 include [6]:

(1) To reduce the energy usage rate at the same time increasing the economic growth.
(2) To facilitate the growth of the GT industry and enhancing its contribution to the national economy.
(3) To increase national capability and capacity for innovation in GT development and enhancing Malaysia competitiveness in GT in the global arena.
(4) To ensure sustainability development and conserving the environment for future generation.
(5) To enhance public education and awareness in GT and encouraging its widespread use.

The Four Pillars of National Green Technology Policy include [6]:

(1) *Energy*: Seek to attain energy independence and promote efficient utilisation.
(2) *Environment*: Conserve and minimize the impact on the environment.
(3) *Economy*: Enhance the national economic development through the use of technology.
(4) *Social*: Improve the quality of life for all.

2.1.4. National Renewable Energy Policy 2010

After suffering 8 years of market failure to promote RE, Malaysia government has launched the National RE Policy 2010 after analysing the issues which brought upon the previous failures.

The vision of National RE Policy 2010 is to enhance the utilisation of indigenous RE resources to contribute towards national electricity supply security and sustainable socio-economic development. This policy consists of five objectives that embody elements of energy, industry and environmental policies, making it convergent in nature [8].

Five objectives under National RE Policy 2010 include [8]:

(1) To increase RE contribution in the national power generation mix.
(2) To facilitate the growth of the RE industry.
(3) To ensure reasonable RE generation costs.
(4) To conserve the environment for future generation.
(5) To enhance awareness on the role and importance of RE.

To ensure the objectives of National RE Policy 2010 is met, five strategic thrusts had been identified. From the launch of the Policy, it is expected that it will bring a positive impact by year 2020. The outcome of National RE Policy 2010 is as shown in Table 2.

Table 2
National RE policy 2010 outcome [8].

Year ending	Cum. total RE (MW)	Share of RE capacity	Annual RE generation (G W h)	RE mix	Annual CO_2 avoidance (tonne)
2011	219	1%	1230	1%	848,493
2015	985	6%	5385	5%	3,715,415
2020	2080	11%	11,246	9%	7,759,474
2030	4000	17%	17,232	12%	11,889,887
2050	21,370	73%	44,208	24%	30,503,589

Five thrusts to ensure the success of National RE Policy 2010 includes [8]:

(1) Thrust 1: Introduce appropriate regulatory framework.
(2) Thrust 2: Provide conducive-environments for RE businesses.
(3) Thrust 3: Intensify human capital development.
(4) Thrust 4: Enhance RE research and development.
(5) Thrust 5: Design and implement an RE advocacy programme.

Expected Impact of National RE Policy 2010 by year 2020 as is outlined below [9]:

(1) Minimum RM 2.1 billion savings of external cost to mitigate CO_2 emissions (total 42 million tonnes avoided from 2011 to 2020, on the basis of RM 50 per tonne of external cost).
(2) Minimum RM 19 billion of loan values for RE projects, which will provide local banks with new sources of revenues (at 80% debt financing for RE projects).
(3) Minimum RM 70 billion of RE business revenues generated from RE power plants operation, which can generate tax income of minimum RM 1.75 billion to the Government.
(4) 50,000 jobs created to construct, operate and maintain RE power plants (on the basis of 15–30 job per MW).

2.2. *Renewable Energy Programmes*

During 8MP and 9MP, several programmes were launched in Malaysia to promote RE utilisation, namely, SREP, BioGen Project, MBIPV, and CETREE. Earlier programme before the Fifth Fuel Policy 2000 which is not included in this paper is the Photo Voltaic (PV) System for Rural Electrification Programme.

2.2.1. *Small Renewable Energy Power (SREP) Programme*

SREP was launched on the 11th May 2001. The launching of the programme is among the steps taken by the Government to develop the utilisation of RE (fifth fuel) under the Fuel Diversification Policy into the country's energy mix [10]. The major concerns under this programme is to encourage private sectors to invest into small power generation projects using RE such as, biomass, biogas, mini-hydro, solar and wind energy [4]. To manage and co-ordinate the implementation of RE, Special Committee on Renewable Energy (SCORE) has been put together under KeTTHA. On the other hand, to help facilitate the industry's participation in SREP, a secretariat functioning as a One-Stop Centre has also been set up at the Energy Commission [10].

Small power generation plants which utilise RE can apply to sell electricity to the Utility through the Distribution Grid System. Project developers are required to negotiate directly with the relevant Utility on all aspects relating to the RE Purchase Agreement, including the selling price on a "willing-seller, willing buyer" and "take and pay" basis. The RE electricity producers will be given a license for a period of 21 years, which will be effective from the date of commissioning of the plant. The invested small power generation plants may have a capacity of more than 10 MW, but the allowed power export to the distribution grid must not be more than 10 MW [10].

As of February 2010, a total of 43 projects have been approved under SREP. Out of the 43 projects, 17 projects has been licensed with 10 projects already in operation, another 25 projects has yet to be licensed while 1 project is in the process of obtaining the license [11]. Table 3 shows the statistics of SREP projects by fuel source. Out of all the projects, seven projects have signed the Renewable Energy Power Purchase Agreement (REPPA). REPPA is an agreement between utility and project developers that covers the price of electricity, hours of connection to the grid and the penalty for non-compliance. Under SREPP, the previous Renewable Energy Power Purchase Agreement (REPPA) ceiling price agreed upon by the National Power Utility (TNB) for all RE grid connected projects, ranged from 14 to 17 sen/kW h (US4.6 cents/kW h). However, the electricity tariff of 17sen/kW h seems not to provide high enough rate of return to attract investors or project developers given the size of the project under SREPP. Consequently, the Government has increased the electricity tariff for biomass and biogas projects to 19 sen/kW h in September 2006 and subsequently the price has been adjusted to 21 sen/kW h effective August 2007. However, the

Table 3
Statistics of SREP projects by fuel source (as on February 2010) [11].

Energy	Sources	No. of approved projects	Grid connected capacity (MW)	Remarks
Biomass	Empty Fruit Bunch	19	189	4 projects with total of 40 MW are in operation
	Wood Chips	–	–	–
	Rice Husk	1	10	–
	MSW	1	5	This project is in operation
Landfill gas		2	3	1 project of 2 MW is in operation
Biogas (agro-based)		7	17.85	1 project of 1.7 MW is in operation
Mini-hydro		13	61.3	3 projects with total of 8 MW are in operation
Wind and Solar		0	0	–
Total		43	286.15	10 projects with the total capacity of 56.7 MW are in operation

price for other RE resources such as Hydro and Solar remain at 17 sen/kW h [12].

The power plants on operation are Jana Landfill (2 MW), TSH Bio-Energy Project (10 MW), Kina Biopower (10 MW), Seguntur Energy (10 MW), Recycle Energy (5.5 MW), Esajadi Power (2 MW), and Amcorp Properties Berhad (4 MW) [4].

The progress of SREP is rather slow, it was targeted to achieve a power generation of 600 MW by year 2005, however by July 2009, the total capacity of power generation from RE is only 56.7 MW [1]. The power plants on operation are Jana Landfill (2 MW), TSH Bio-Energy Project (10 MW), Kina Biopower (10 MW), Seguntur Energy (10 MW), Recycle Energy (5.5 MW), Esajadi Power (2 MW), and Amcorp Properties Berhad (4 MW) [4]. One of the main reasons for this consequence is the low rate of return which fails to attract investors to invest in SREP. However, with the launch of FiT, it is expected to intensify further the SREPP project development and to meet the target set under 10MP.

2.2.2. Biomass Power Generation and Demonstration (BioGen) Project

BioGen project was then introduced in October 2002 with the ultimate objective to promote and demonstrate biomass and biogas grid-connected power generation projects and reduce the growth rate of greenhouse gas (GHG) emissions from fossil fuel by utilising excess oil palm biomass residues. BioGen facilitates development of the grid connected biomass-fuelled small power systems, disseminates awareness information in palm oil industry, provides building and technical assistance in policy formulation, and financial facility assistance through favorable bank loans and tax exemption among others. Some of BioGen significant projects include the first 14 MW (export 10 MW) power plant in Tawau, Sabah which uses oil palm residues (empty fruit bunch, fibre and shell) that successfully mitigate 40,000–50,000 tonnes of CO_2 in 2004 and more recently, a 46.2 MW and 500 kW power plants are grid-connected and commissioned in April 2009 and a total of 700 MW off-grid electricity has been produced by private palm oil millers [1].

BioGen received financial aid of about USD 14.7 mil from the United Nation Development Programme (UNDP), cofounded by Global Environment Facility (GEF), the GoM and private sectors [4].

2.2.3. Malaysia Building Integrated Photovoltaic Technology Application (MBIPV)

MBIPV is a 5-year project launched in 25th July 2005 and end in 31st December 2010. This project is funded by the GEF and UNDP with a fund of about USD 4.7 million [13]. The primary objective of MBIPV project is to reduce GHG emission from the country's electricity sector by reducing the long-term cost of Building Integrated Photovoltaic, BIPV technology within Malaysia market. The project specifically focuses on the market development for BIPV technology, and building the national capacities on three major areas (policy and education, technical skill and market implementation, and technology development support) [4].

In 2005, the 5-year MBIPV project was launched to reduce BIPV technology cost in the Malaysian market and to generate widespread BIPV applications by creating a sustainable BIPV market in Malaysia. Over the lifetime of the project, the energy generated is expected to be able to avoid 65,100 tonnes of CO_2 emissions from the country's power sector. The MBIPV program has been successful in achieving a tremendous increase in solar energy utilisation in the country through its Suria1000 program. As of December 2009, the cumulative grid connected PV capacity in Malaysia was recorded at 1416 kWp, an increase of 203 percent compared to 468 kWp in 2005. At the current pace of achievement, it is possible to attain more than the project's target of installed BPIV capacity of 330 percent with a 20 percent cost reduction by 2010. From the awarded capacity, 1084 kWp representing 65 systems have been commissioned and connected to the TNB grid. The unit cost of the grid-connected BIPV system has also reduced to RM 19,120 kWp^{-1} from the baseline of RM 31,410 kWp^{-1} in year 2005 which translates to 40 percent cost reduction. In addition, a total of 1070 tonnes of CO_2 equivalent GHG emissions have been avoided through the displacement of fossil fuel with the installment of the PV system.

During MBIPV's 5-year duration, three main programmes are implemented to encourage investment in BIPV projects as well as accelerate the development of the local PV market. The three programmes includes, showcase, demonstration, and SURIA 1000 and SURIA for developers programmes. Under MBIPV, three housing developers succeeded in implementing BIPV into the system. All three developments obtained 30–35% subsidy.

Three housing developers who succeeded are [14].

(1) SP Setia at location Setia Eco. Park in Shah Alam, Selangor
(2) Putrajaya Perdana at location Precinct 16 of Putrajaya
(3) AmarinWickham at U-Thant area of Kuala Lumpur

Other successful initiatives during the MBIPV project included [14]:

(1) Setting up of a PV monitoring centre at Universiti Teknologi-MARA
(2) Launching of PV business development program
(3) Implemented approved service provider scheme
(4) Started quality assurance scheme
(5) Organized national PV conferences
(6) Created PV awareness such as essay and drawing competitions among school children under the Ministry of Education

MBIPV project's target of an improvement of 330% of the installed BPIV capacity and a 20% reduction it the unit cost by 2010. In 2005, the installed BPIV capacity is only 468 kWp and the unit cost is RM 31,410 kWp^{-1}. In December 2009, 1416 kWp of cumulative grid-connected PV was recorded, an increment of 203% since 2005. The unit cost of PV reduction exceeded the project's target of 20%, and in December 2005, a reduction of 40% is observed with the unit cost of RM 31,410 kWp^{-1}. From the implementation of BIPV, a total of 1070 tonnes of CO_2 equivalent GHG emissions have been avoided [15].

2.2.4. Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE)

One of the barriers which prevent large scale implementation of RE in Malaysia is due to the low level of knowledge and awareness regarding RE. The prime purpose of CETREE is to counter these issues by increasing the level of knowledge and awareness in Malaysia education. This project would introduce the concept of RE and EE into the curricular activities in schools and universities. In August 2006, three competitions emphasising on RE and EE were organised under the collaboration of CETREE and the Ministry of Education Malaysia. The three competitions are regarding the solar cars, cooking with solar cookers and RE and EE beach houses. To date 8260 students and 1714 teachers and lecturers have visited CETREE, along with 14,109 member of the public. CETREE now hosts an interactive website to disseminate information on EE and RE [10].

2.3. Renewable energy incentives and Feed-in Tariff (FiT)

2.3.1. Renewable energy incentives

To encourage the growth of RE utilisation in Malaysia, GoM has established several incentives such as pioneer status (PS) and investment tax allowance (ITA). Initiatives to utilise RE begins when SREP is launched, since then many incentives has been formulated

Table 4
Incentive for the use of RE resources [10].

Incentives for the use of RE	Resources
Companies generating energy from renewable sources	PS with tax exemption of statutory income for a period of 10 years or ITA of 100% on the qualifying capital expenditure incurred within a period of 5 years with the allowance deducted each year of assessment to be set off against 100% of statutory income for each year of assessment. Equipment used for the project will be given import duty and sales tax exemption if not produced locally. Equipment purchased from local manufacturers will be given sales tax exemption. Another company which in same group were given PS or ITA as above even though one of the company in that group have gotten tax incentives.
Companies generating energy from renewable sources for own use	ITA of 100% on the qualifying capital expenditure incurred within 5 years with the allowance deducted each year of assessment to be set off against 100% for each year of assessment. Companies not generating energy which import or acquire equipment generate energy from renewable sources for third party use such as housing developer or building owner has not been given tax incentive.
Companies which import system equipment solar PV for third party use or purchase heating system equipment solar from local manufacturer	Import duty and sale tax exemption on PV solar system equipment for third party use was given to importer including service provider PV approved by Commission Energy. Sale tax exemption given on system equipment purchase heating solar from local manufacturer. This incentives applicable for applications received by Ministry of Finance is until 31 December 2010.

for a sustainable social-economic development. Since then, the incentives have been improvised over the years to further enhance the promotion of RE in to Malaysia.

Currently, the incentives given are based on 2009 budget and are only applicable until 31st December 2010. Once the incentive is approved, the applicant is required to implement the project within one year from the date of approval. Malaysian Industrial Development Authority (MIDA) and Energy Commission are the two implementing agencies for the incentives. MIDA function as one stop centre for processing and energy commission function as technical evaluation for energy efficiency projects and products [11]. As of to date, the incentives provided can be divided into three different categories, energy efficiency incentives, incentives for the use of RE resources and incentives for green building. This review paper will only cover for the incentives for the use of RE resources as shown in Table 4 [10].

2.3.2. *Feed-in Tariff (FiT)*

FiT has been proven to be the most effective mechanism and cost-effective way to foster renewable energy rather than other policy mechanisms such as quotas, direct incentives or voluntary goals. It was successfully implemented for over 40 countries in the world such as Germany, Spain, Italy, Thailand. FiT provides a guarantee of payments in dollars per kilowatt hour ($/kW h) for the full output of the system for a guaranteed period of time (typically 15–20 years). FiTs are payments for the utilisation of electricity generated by RE in kilowatt-hour (kW h). Under the FiT proposed and to be launched by 2011, it mainly covers solar PV, biomass, biogas, and mini-hydro [3]. In 2nd April 2010, RE Act and Act for FiT Implementing Agency has been approved by the Cabinet while under the 10MP, the National RE Policy 2010 and Action Plan were launched.

Table 5
Renewable tariffs in Malaysia (proposed for 2011) [3].

RE utilisation	Years	RM/kW h	Degression
Solar PV			
<4 kW	21	1.23	8.0%
>4 kW < 24 kW	21	1.20	8.0%
>24 kW < 72 kW	21	1.18	8.0%
>72 kW < 1000 kW	21	1.14	8.0%
>1 MW < 10 MW	21	0.95	8.0%
>10 MW < 30 MW	21	0.85	8.0%
Bonus for rooftop	21	0.26	8.0%
Bonus for BIPV	21	0.25	8.0%
Bonus for local modules	21	0.03	8.0%
Bonus for local inverters	21	0.01	8.0%
Biomass			
<10 MW	16	0.31	0.5%
>10 MW < 20 MW	16	0.29	0.5%
>20 MW < 30 MW	16	0.27	0.5%
Bonus for gasification	16	0.02	0.5%
Bonus for steam generation > 14% efficiency	16	0.01	0.5%
Bonus for local manufacturer	16	0.01	0.5%
Bonus for MSW	16	0.10	1.8%
Biogas			
<4 MW	16	0.32	0.5%
>4 MW < 10 MW	16	0.30	0.5%
>10 MW < 30 MW	16	0.28	0.5%
Bonus for gas engine > 40% efficiency	16	0.02	0.5%
Bonus for local manufacturer	16	0.01	0.5%
Bonus for landfill or sewage gas	16	0.08	0.5%
Mini-hydro			
<10 MW	21	0.24	0.0%
>10 MW < 30 MW	21	0.23	0.0%

A tariff for RE is not new to Malaysia. Since 2001, under the SREP, a tariff for RE had been introduced. Due to high tariff rate for wind and solar, investors were not attracted to invest for wind and solar RE. However, even with low tariffs for biomass and biogas, investment for these renewable energies did not gain much success. The new FiT was introduced to improvise the previous tariff and it is expected that after the launching of the new FiT by 2011, the scenario on RE investment would change drastically. The new improvise tariffs is as shown in Table 5. The maximum tariff for solar PV is RM 1.23 $kW\,h^{-1}$ and a minimum of RM 0.85 $kW\,h^{-1}$ with a degression of 8.0%. As for biomass, the maximum tariff is RM 0.31 $kW\,h^{-1}$ and minimum of RM 0.27 $kW\,h^{-1}$ with a degression of 0.5%. Biogas stands for RM 0.32 $kW\,h^{-1}$ (maximum) and RM 0.28 $kW\,h^{-1}$ (minimum) with a degression of 0.5%. Mini-hydro is of RM 0.24 $kW\,h^{-1}$ (maximum) and RM 0.23 $kW\,h^{-1}$ (minimum) with no degression.

Critical factors to ensure the success of FiT and for an effective FiT mechanism is as listed [16]:

(1) Access to grid is guaranteed
(2) Approval procedures are streamlined and clear
(3) Rates must be high enough to produce a return of investment and reasonable profit
(4) Rates must be fixed for a certain period – to give certainty and provide businesses with clear investment environment
(5) Adequate degression for the FiT rates to promote cost reduction – to achieve grid parity
(6) Adequate fund is created to pay the FiT incremental cost and guarantee the payment for the whole FiT period

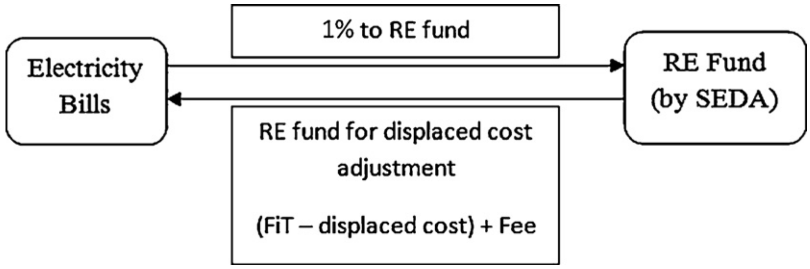


Fig. 1. Flow of RE funding [8].

(7) Implementation by a competent agency in a professional manner that includes constant monitoring, progress reporting and transparency

Sustainable Energy Development Authority (SEDA) will be set up to ensure the success of this project. SEDA's functions are as listed [9]:

(1) advise the Minister and Government Entities on all matters relating to sustainable energy
(2) promote and implement national policy objectives for RE
(3) promote, stimulate, facilitate and develop sustainable energy
(4) implement, manage, monitor and review the FiT system
(5) implement sustainable energy laws including the RE Act and recommend reforms
(6) promote private sector investment in sustainable energy sector
(7) carry out/arrange research and development, advisory services and disseminate information
(8) implement measures to improve public awareness
(9) act as focal point to assist the Minister on matters relating to sustainable energy and climate change matters relating to energy

In Malaysia, with the initiatives set by government to ensure the success of this project, it is expected that 42 million tonnes of CO_2 could be curbed from power generation by 2020. The amount is expected to further increase by 2030, to 145 million tonnes of CO_2 [17].

2.4. Fund and Financing Scheme

In the context of RE in Malaysia, other than the incentives, financial supports are also available for the development of RE. Under FiT project, a RE Fund is established. Other than that, there are also the Renewable Energy Business Fund (REBF), Green Technology Financial Scheme (GTFS) and Renewable Energy and Energy Efficiency Scheme.

2.4.1. Renewable Energy Fund under Feed-in Tariff (FiT)

Under RE fund by Pusat Tenaga Malaysia (PTM), consumers who utilise electricity more than the set minimum point must contribute 1% of their bill towards the fund. The collected fund will then be used to equalize the price between non-renewable and renewable sources of energy administered by SEDA, under KeTTHA [13]. Fig. 1 shows the flow of RE funding for FiT under SREP.

2.4.2. Renewable Energy Business Fund (REBF)

The objective to set up the REBF is mainly for BioGen implementation programme to support the financial need of Full Scale Model Biomass Power Project. This REBF is expected to act as a successful model in financing RE Project in Malaysia in order to give better perspective to other developers and financial institutions towards developing and financing the same mechanism of RE project in the country. The total size of the fund is RM 28.0 million which is equally contributed by PTM and Bank Pembangunan Malaysia Berhad (BPMB) (formerly Bank Industri & Teknologi Malaysia Berhad). The fund from PTM portion is a contribution from GEF of RM 9.2 million and Malaysian Electricity Supply Industry Trust Account (MESITA) of RM 5.0 million [16].

Table 6
Project application status under GTFS [18].

Project certification (technical)	No. of projects
Completed project applications under evaluation	12
Certified Green projects	68
Rejected applications	14
Financing applications	
Approved Green project for financing	10
Approved GT value for financing	RM 141,902,500.00
Balance of GT value for financing	RM 1,358,097,500.00

2.4.3. Green Technology Financial Scheme (GTFS)

Beneficial mostly to producers and users of green technology, GTFS is mainly set up to improve the supply and utilisation of GT. Under this project RM 1.5 billion is allocated for development. The most significant advantages of GTFS are that the Government will bear 2% of the total interest/profit rate, and provide a guarantee of 60% on the financing amount via Credit Guarantee Corporation Malaysia Berhad, with the remaining 40% financing risk to be borne by participating financial institutions [18].

The Prime Minister of Malaysia, Dato' Seri Najib Tun Abdul Razak also appoint the GreenTech Malaysia as the conduit for the GTFS application. The scheme is expected to provide benefits to more than 140 companies [18]. As of 10th December 2010, 10 green projects have been approved for financing with the total amount of RM 141,902,500 as shown in Table 6. With a large remaining amount of fund, it is expected that the growth of GT will proliferate in the next few years.

2.4.4. Renewable Energy and Energy Efficiency Scheme

Under the BPMB scheme, wide range of financing facilities for RE and EE projects especially on biomass, biodiesel, mini-hydro, solar, MSW and energy efficiency is offered. From this scheme, the RE and EE scheme were introduced in 2006 with two phases. The second phase, known as RE and EE Scheme II was introduced in 2007.

RE and EE Scheme I allow a business to borrow up to 80% of total project cost with attractive interest rate and repayable up to 15 years. The second phase increases the allocation by RM 1.0 billion to attain the anticipated increase interest in RE projects. The companies are allowed to borrow up to 85% of total project cost with attractive interest rate and repayable up to 15 years [16].

3. Conclusion

Global warning issue together with the depletion of fossil fuels and escalating petroleum prices have encouraged Malaysian

government to start focusing on renewable energy as promising sources in global energy mix and now becoming the key components in the drive towards energy diversification. RE was first introduced in the country's energy mix through the Fifth-Fuel Policy which was formulated under the 8MP. Over the past 10 years, many different policies, programmes, funding and schemes, and incentives has been introduced by the government of Malaysia to promote the implementation of RE as an alternative energy.

In addition, RE utilisation was being promoted with more emphasis under the 9MP. However, RE implementation is slow to be materialized. Due to this scenario, under the 10MP, Malaysia introduced the RE Action Plan which spelled out in detail the way forward to increase the market share of RE in the generation mix of the country.

Even though the development of renewable energy in Malaysia is still in the early stage, it was estimated that by utilising only 5 percent of renewable energy in the energy mix could save the country RM 5 billion (US$ 1.32 billion) over a period of 5 years. Therefore, the effective policies and attractive incentive on RE by the government is crucial to develop and promote the utilisation of RE resources.

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